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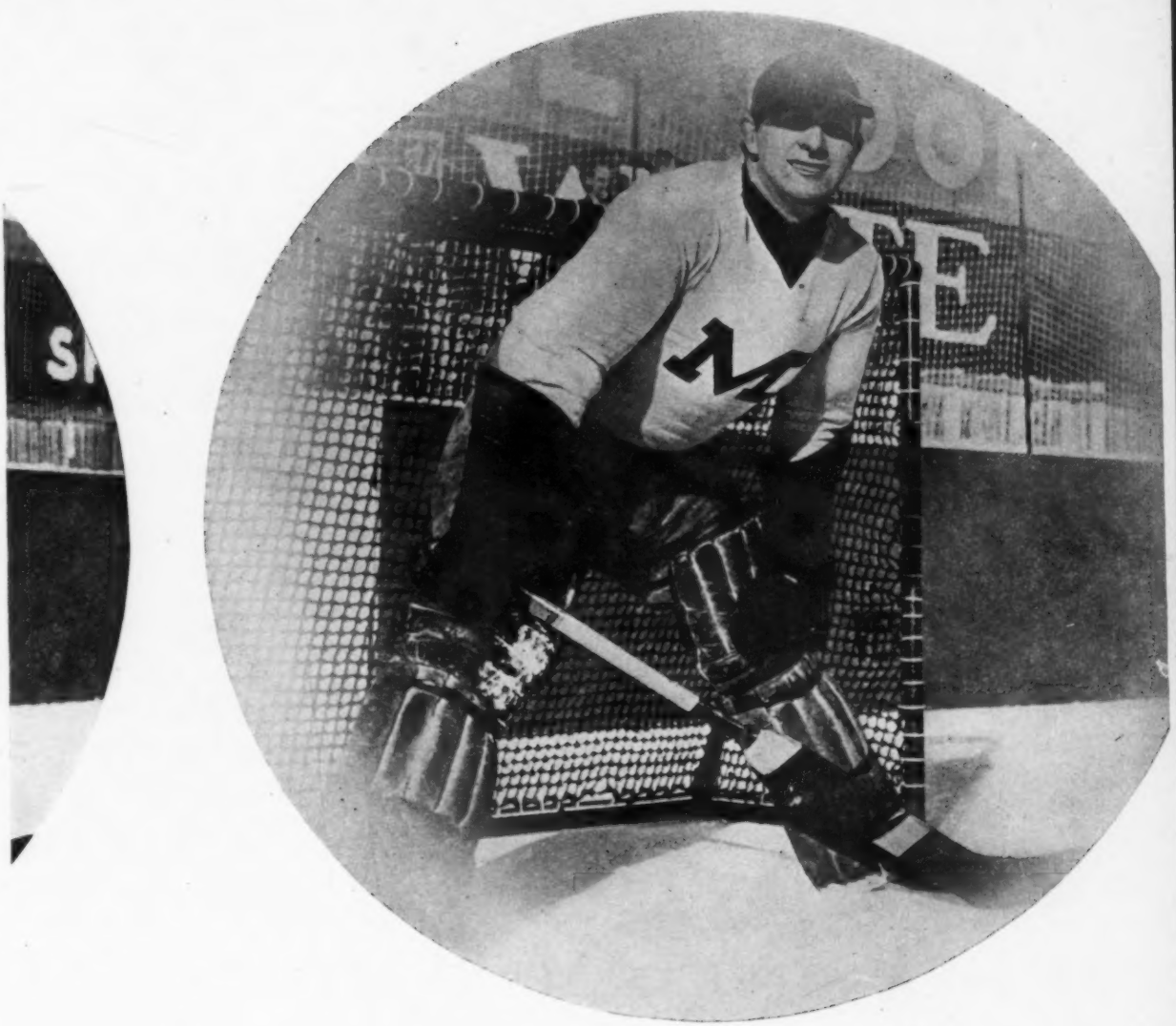

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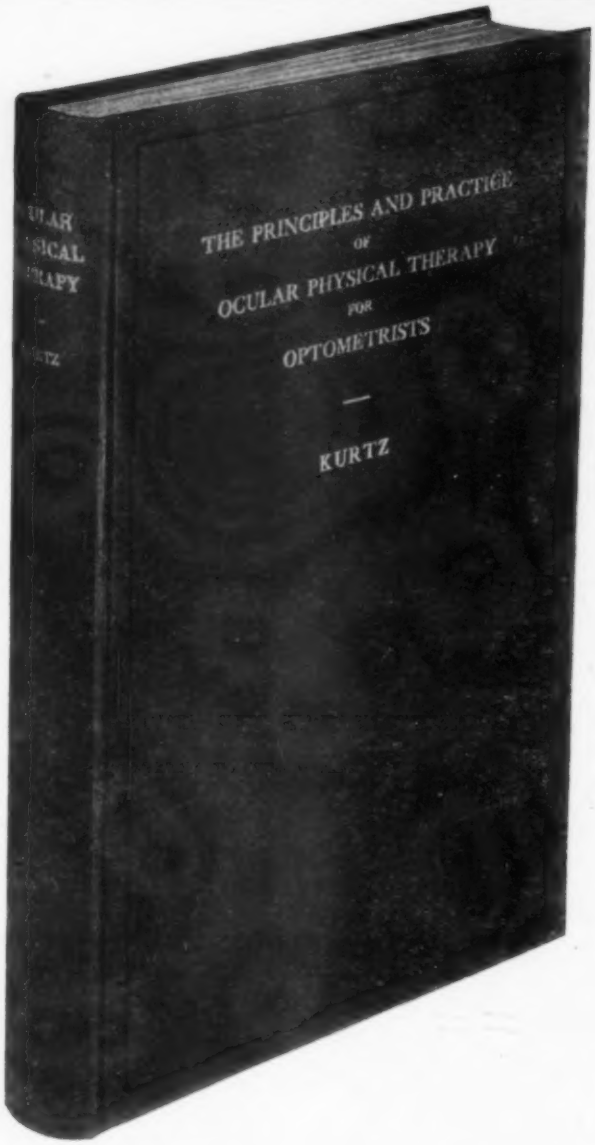

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AMERICAN JOURNAL OF OPTOMETRY

Vol. 14 FEBRUARY, 1937 No. 2

A PLASTIC CONTACT LENS*

William Feinbloom, B.S., M.A., D.O.S., F.A.A.O.
Research Fellow, Columbia University
New York City, N. Y.

FOREWORD

For the past 80 years, ever since the first conception of a CONTACT LENS, optical science has been challenged to produce a lens molded to the individual eyeball. An individually molded CONTACT LENS was always predicated upon the equally bold idea of obtaining a mold of the living eyeball.

Even though a complete solution to the visual problem of the CONTACT LENS has been previously presented (Feinbloom, 1930 Transactions of the American Academy of Optometry), the difficulties of securing a mold of the eyeball seemed insurmountable.

Those difficulties, however, connected with the use of previously developed forms of CONTACT LENSES left no choice but to undertake what proved to be a long, and arduous series of experiments.

The research finally led to the enunciation of three clear-cut problems, as follows:

1. A technique for taking an impression or a mold of the living eye.
2. A method of theoretically determining the necessary tolerances between the surface of the eye and the inner surface of the lens.
3. A technique for forming a CONTACT LENS by a molding process.

Unless accurate tolerance was achieved, it was found impossible for the patient to wear the lens for any considerable length of time.

THE GENERAL PROBLEM OF CONTACT LENSES

Putting a CONTACT LENS in the eye, under the lids, may be likened to the use of artificial teeth and dentures of various kinds. Both in a sense represent foreign bodies placed against live tissues. The difference how-

*An abridgment of the material presented before the American Academy of Optometry at Chicago, Ill., August 23, 1936.

ever, is that the gums and other tissues of the mouth bear teeth from childhood, and the artificial dentures merely replace missing teeth; whereas, the CONTACT LENS is always an addition to the eye.

At first appearance, it might be supposed that such a foreign body in contact even with the fairly non-sensitive sclera, could not be tolerated, particularly in view of the sensitiveness of the conjunctiva. However, the use of various braces in orthodontia, which definitely are foreign bodies in the mouth, suggest that negative conditioning to such unnatural and rather painful stimuli occurs in the mouth.

Assuming that the CONTACT LENS is so placed under the lids as not to touch the cornea and has smooth surface and edges, it has been amply demonstrated that negative conditioning does occur in the eye. In fact, when the lens properly fits, no irritation or discomfort results, even after a day's use.

The attempts to obtain a perfect fitting of the CONTACT LENS had previously resulted in two types of CONTACT LENSES; one "ground" type, the other the "blown" type. Both of these forms of CONTACT LENSES may be likened to the old fashioned "store teeth."

Before the method of impression taking had been developed in dentistry, various sizes and forms of dentures of artificial teeth were made and the best possible fit was selected for the patient's mouth. These teeth, of course, never fitted satisfactorily and so, too, with the above mentioned type of CONTACT LENSES.

Simple inspection of an eyeball clearly indicates that the sclera does not even approach a spherical surface. This is the fundamental reason why "ready made" CONTACT LENSES of the ground type cannot be expected to fit, as a general rule. Whereas the blown type may be made to fit with considerable comfort, because in general it deviates considerably from a spherical surface, the chances of securing a good visual correction and a "good scleral fit" with any one lens, are necessarily small.

Examination of the literature, as well as our own experience over the past six years, definitely indicates that not more than a small percentage of the patients who desire to wear CONTACT LENSES, could tolerate either of the old types for more than a few hours. The necessity for securing a uniform tolerance of the order of .001 inches to avoid the collection of oil, makes other than a plastic form of CONTACT LENS a haphazard affair.

Most of the symptoms that resulted from the use of these lenses, even for short periods, were excessive lachrymation, burning sensations, photophobia, irritation and pain.

In many cases where the lens seemed to fit satisfactorily, so that no irritation or pain existed, the vision would blur after four or five hours' use, because of the collection of oil under the lens.

THE GEOMETRY OF A CONTACT LENS ON THE EYE

Let us consider the mechanics involved in the adherence of a CONTACT LENS to an eyeball.

The eyeball itself, as a mechanical model, may be considered as one ellipsoid (the sclera) of some elasticity, having superimposed at the apex of one of its axes a section of another ellipsoid (the cornea). The scleral ellipsoid is covered with an inelastic tissue (the conjunctiva).

When the CONTACT LENS is filled with water and placed against the eyeball, an anterior-posterior suction force is generated, due to the presence of atmospheric pressure and the close fitting edges of the lens against the sclera (or conjunctiva). This holds the lens against the eyeball.

If the surface of the lens does not properly correspond to the surface of the globe, then this suction force will cause some parts of the lens to compress the inelastic conjunctiva, with consequent irritation to the tissues and the blood vessels in it. This will naturally give rise to many of the subjective symptoms previously mentioned.

When the eye is in motion, the lid pressure generates a horizontal torque, tending to slide the lens toward the nose. Suitable change in curvature of the inner surface of the lens must be made to neutralize this action. Similarly, when the eye moves so as to generate a vertical torque, other compensations must be made in order to prevent the lens surface from severely pressing the conjunctiva at any point.

Even if we were to assume that the eyeball were spherical, then it follows, from simple geometry, that another spherical surface, concentric with the eye, would not press equally at all points on the surface when acted upon by this anterior-posterior force. This led to the derivation of the precise form the surface must take in order that this pressure be equal at all points.

Experiments with hundreds of molds left no doubt as to the fact that the surface of the sclera in no way resembles a sphere. By means of enlargements through opaque projection, it was possible to measure the radii at numerous points of curvature. The data in general shows differences from the order of 14.0 mm. to almost infinity.

Even when we have a lens whose inner surface properly corresponds to the surface of the eyeball, and if we assume that the suitable tolerance has been allowed for the various forces and torques that operate while the eye is in motion, we must make still another allowance. This allowance must be one that will allow the lens to fit loose enough so that there is a fairly free exchange of tears and oil under the glass. If this free exchange does not occur, then we have the symptoms usually presented even in the best fitting ground and blown type of CONTACT LENSES, namely, the collection of oil under the lens and a consequent blurring of the vision.

TEC''NIQUE OF TAKING A MOLD OF THE EYE

A method had to be developed that would be non-injurious and painless. Further, the eyes had to be allowed to move freely about while the impression was "setting." The technique must be one that would not distort the conjunctiva nor the eyeball, and that would give a sufficiently large portion of the sclera to be embodied in the CONTACT LENS.

A long time was spent experimenting with such materials as dental plasters and dental stone. These methods invariably failed because of the inability of the eyeball to remain fixed for more than a few seconds at a time.

Similarly, experiments were made with substances that were poured in a liquid state and allowed to solidify, such as wax of low melting point, Negocoll or Dentocoll.

These substances required some form of a dam in order that the impression might be removed without breaking. The use of a metal dam resulted in the bulbar conjunctiva folding up on itself, causing wrinkles to appear on various scleral parts of the impression. Attempts to counteract this by the use of heavy oils proved only partially successful. The time of setting of these materials was satisfactorily reduced to a period of approximately 10 seconds by the use of a freezing agent, such as frozen carbon dioxide.

Another method that gave even less satisfactory results, and thus had to be abandoned, was the use of a container formed like a CONTACT LENS. Either wax, Negocoll or Dentocoll was used here as the impression material. This dam was placed under the lids and allowed to set. The objection to this technique was that the glass or metal dam, being harder than the eyeball itself, impressed its own form on the impression material, thus rendering it impossible to obtain an accurate impression of the eye.

The technique that was finally evolved for taking accurate molds of the eye, is outlined as follows:

STEP 1: A thin layer of wax is first pressed into the general form of the eye. In its center is placed a suitable corneal glass lens. The contour of this layer of wax is formed differently for the right and left eyes.

We will hereafter refer to this wax preparation, binding the corneal glass lens, as the "impression CONTACT LENS."

STEP 2: The doctor holds the impression contact lens in his hand with the aid of a small rubber suction nipple attached to the corneal glass portion.

STEP 3: He then partly fills the impression contact lens with half normal saline solution. The solution should be a little above body temperature. (The impression CONTACT LENS may now be regarded as a trial CONTACT LENS, for it has a corneal section previously computed so as to have the correct refracting power, and a scleral section which here is a thin layer of wax.)

STEP 4: The doctor next retracts the lids of the patient's eye, which has previously been anaesthetized with 2% Butyn. The impression CONTACT LENS is now inserted under the lids. It is held in place by suction. The lids are allowed to close over the impression lens, the suction released and the rubber nipple withdrawn. (In effect, the patient now has a contact lens in the eye.)

STEP 5: The patient is permitted to retain this impression CONTACT LENS for approximately ten to fifteen minutes. During this time, the heat of the body, as well as the pressure of the lids, will mold the thin layer of wax accurately to conform to the surface of the eyeball. Simple inspection during this period will insure that the wax is properly molded.

STEP 6: While the impression CONTACT LENS is still in the eye, the patient's cornea must be examined with the aid of a slit-lamp microscope. This examination must clearly reveal that the corneal glass section at no point is resting against the cornea of the eye. A suitable tolerance of 0.5 mm. should be allowed between the cornea and the inner surface of the glass corneal section.

STEP 7: At the end of the ten to fifteen minute period. the eye is irrigated with ice water. This insures that the wax, which has already been formed to the eyeball, will harden and not bend during removal from the eye.

STEP 8: The rubber suction nipple is again applied to the glass portion of the impression CONTACT LENS. The patient's lids are once more retracted, the lens suction broken, and the impression CONTACT LENS removed from the eye. This should now be placed in ice water until ready for molding with plaster.

STEP 9: Dental plaster is mixed, poured into the impression CONTACT LENS and allowed to set. The lens is then removed from the plaster and we have left the mold of the eye. The scleral portion of the eyeball is represented by the scleral rim of this mold, and the inner curve of the glass corneal lens is represented by the corneal section of the mold.

With the first problem of obtaining an impression of the eyeball satisfactorily solved, consideration was given to:

THEORETICAL DETERMINATION OF THE NECESSARY TOLERANCE

The inner surface of the finished lens is required to be kept from the eye by some predetermined amount (0.50 mm). One of the forces acting on the lens may be considered as translational anterior-posterior in direction. The second is a rotational horizontal torque produced by the scissor action of the lids. This torque is generated by a gradient force which is minimum at the outer canthus and maximum at the inner canthus. The third is a rotational vertical torque produced by the vertical action of the lids. This torque is generated by a gradient force which is a minimum at the lower lid and a maximum at the upper lid.

Given the data of the radii of curvature of the eyeball (experi-

mentally determined from the mold of the eyeball), it becomes a simple problem in spherical geometry to determine the necessary deviation that the inner surface of the plastic CONTACT LENS must have, in order that with these three forces acting it shall still remain 0.50 mm. at all points from the eye.

Since the curvature varies considerably from meridian to meridian, it is necessary to select a sufficient number as representative. Further, since the radii vary considerably from eye to eye, it is necessary to repeat these computations for each eye.

With an understanding of the necessary tolerance or deviation that had to be made, our next problem was to find a suitable material. This led to the problem of a:

TECHNIQUE FOR MAKING A PLASTIC CONTACT LENS FROM A MOLD OF THE EYE

The method for making a completed plastic CONTACT LENS from a mold of the eye is, in general, similar to that used in making artificial dentures from casts of the mouth.

For the plastic CONTACT LENS, we use a glass corneal center and bind it with a plastic resin. This resin, when vulcanized, develops the properties of being transparent, hard, acid resisting and capable of high polish, thus insuring a smooth surface. The completed vulcanized lens is ½ mm. thick throughout. The edges and surfaces are ground and polished.

The steps for making such a finished lens may be summarized as follows:

STEP 1: The mold of the eye, with the glass corneal section in place, is covered with approximately 1 mm. thickness of wax, to be known as the "wax model."

STEP 2: The wax model is invested in the lower half of a dental flask, and then tin foiled.

STEP 3: A female of the wax model is now formed in the upper half of the dental flask.

STEP 4: The entire flask is then boiled for ten minutes to allow the wax to melt out. This then leaves a space between the male and female molds of the eye.

STEP 5: The two halves of the flask are separated. The female portion is already tin foiled. The male portion must now be tin foiled, also. The manner and thickness of this tin foil depends on the tolerance theoretically determined between the inner surface of the lens and the surface of the eyeball. These tolerances will range anywhere from .001 inch to .040 inch, depending on the particular curvature of the mold in different section. The space between the upper and lower halves of the models is then filled with plastic resin.

STEP 6: The flask is again closed and placed in the vulcanizer. The time and temperature of vulcanization is determined by the par-

ticular resin used, as well as the hardness and transparency desired.

STEP 7: After vulcanization, the flask is cooled, the two halves separated and the lens removed from the tin foiled covering.

STEP 8: The outer surface of the plastic contact lens is ground so as to leave the scleral portion of the desired thickness, approximately ½ mm. Any resin that adheres to the inner or outer surface of the glass is easily removed by grinding. The inner surface of the lens will already be smooth. The outer surface, as well as the edges, must be carefully polished in order to insure a smooth surface.

SUMMARY AND CONCLUSION

The development of the plastic CONTACT LENS was the result of the inherent difficulties present in the "Blown" and "Ground" type. No suitable information existed as to why certain lenses fitted partly and the majority not at all. The problem of securing tolerance, in the words of the writer in 1930, was "still in the experimental stage." That ready made CONTACT LENSES could never fit more than a few cases was acknowledged by the whole profession.

The further fact that patients, young and old, were anxious for such lenses, that their optical usefulness in conical cornea, irregular astigmia, corneal scars, nearsightedness, farsightedness, astigmatism, and cases following cataract removal, had been amply demonstrated, also influenced us towards starting these researches.

By this time, too, it has been established, to the satisfaction of both profession and public, that CONTACT LENSES are safe, and that no more risk is involved in their use when properly fitted than in ordinary spectacles. Their superiority over spectacles in swimming, tennis, motoring, riding and other sports, has readily been acknowledged.

Possibly the ever-existing desire to complete the seemingly scientific impossible helped, too, in furthering a study undertaken six years ago.

Our investigations have provided a method for:

1. Taking an accurate impression of the human eyeball.
2. Determining the tolerance to allow for any given eyeball, in order to secure a proper inner surface for the plastic CONTACT LENS.
3. Making a CONTACT LENS having a central glass portion properly ground to the patient's visual requirements, and a scleral section made of a plastic resin molded to the computed curves required.

Acknowledgment

A work such as this which has its roots in ideas and suggestions dating back many years, could necessarily only have been completed with the aid and cooperation of many people. We wish to take this opportunity to thank them all. We must, however, select for special

mention because of their real help and persistent encouragement, certain ones of them.

Mr. Samuel C. Greenfield, Instructor of Mathematics, whose comprehensive analysis of the problems exceeded that of any of us.

Mr. George S. Weith, Chief of Research Division of the Bakelite Corporation of America. It was through his industrious efforts that plastic resin having suitable physical properties was finally developed. The cooperation with the Bakelite Corporation through Mr. Weith left nothing to be desired.

Mr. Moses A. Greenfield of our own scientific staff, whose interests in our technical problems date back for many years. His scientific promise which we recognized at that time is amply being fulfilled.

We must also mention Captain C. H. Knowles, who in the last part of the work offered many useful ideas and brought with him an enthusiasm that helps see the problem through to the end.

DR. WM. FEINBLOOM,
138 EAST 36TH ST.,
NEW YORK CITY.

DISCUSSION

DR. ELMER E. HOTALING: The Academy is indeed fortunate to have presented before it this latest development of our colleague Dr. William Feinbloom. His contribution is particularly gratifying because it was the American Academy of Optometry which first recognized his scientific capacities and nurtured them in a form of yearly appointments as Research Fellows at Columbia University. Were it not for this encouragement extended to Dr. Feinbloom this contribution might not now be available to serve humanity.

The greatest significance in the presentation of the Plastic Contact Lens lies in the new field which it opens up for op ometrists and allied professions. Heretofore optometrists were practically restricted to the field of refraction with the subject of sub-normal vision only recently explored. This latest development further extends the science of visual applied optics.

Dr. Feinbloom's paper points out the theoretical requirements for the taking of a personal mold of the eye. These requirements as I see them are first that the eye ball be allowed free movement during the procedure of molding; secondly, that no essential forces be introduced to help form the mold, for such force might well distort the true shape of the eye ball. Thirdly, the forces that normally act on a contact lens when in the eye are allowed to act while taking the mold. The solution of this problem, in my opinion, represents a historical advance in the problem of contact lenses.

For the first time, too, we have a method suggested in this paper of accurately measuring the radii of curvature of the sclera. It is very interesting to note that the radii of curvature of the eye ball can vary from possibly 10 mm. in one region to infinite at another. This readily explains why previous types of ground contact lenses could never be expected to fit. The method of opaque projection for measuring these radii, while seemingly obvious, represents an ingenious solution.

The third important development revealed in these researches represents the use of a suitable plastic resin for the scleral rim. The binding of this plastic resin around the corneal glass lens offers almost unlimited advantages from a refractive point of view.

It should be pointed out, however, that the actual technique of taking an impression of the eye ball as advocated by this paper requires skill and training on the part of the practitioner. From personally observing this technique it is my opinion that some distortion of the wax mold may occur unless the precise technique outlined in this paper is scrupulously followed.

Some question exis s yet as to whether any contraction of the wax occurs when the eye is irrigated with ice water. A second possible source of such experimental error occurs when the wax impression, after being removed from the eye, is suspended in ice water. It is apparent, of course, that the wax, being an inelastic substance, has a very minute co-efficient of expansion, and so, even though there is a change from body temperature to ice water the result in contraction is probably insignificant.

A third possible distortion of the impression may occur when the plastic mold is cast from the wax impression. Precaution must be taken to see that the plastic is sufficiently soft when poured into the wax impression.

From the theoretical consideration of the various forces and torques acting on the finished contact lens, it is apparent proper tolerance must be allowed between the surface of the eye ball and the inner surface of the lens.

We do not doubt that one possible future development will be or may be the use of a glass scleral rim in place of the plastic resin. However, the present development of glass making precludes any possibility of molding glass with the precision required here. The plastic lens can be molded to an accuracy of better than one-thousandth of an inch.

A further significance to the contribution of Dr. William Feinbloom rests upon the fact that in 1930 before this Academy he first presented a complete optical solution of the contact lens problem. Theoretically, at that time he pointed out the remaining important problem was to devise a method of securing tolerance. It is, indeed, gratifying to find that in six years Dr. Feinbloom has resolved this problem into a practical solution.

THE APPRAISAL OF THE EFFECTIVENESS OF ORTHOPTIC TRAINING*

R. M. Hall, A.B., B.Sc., F.A.A.O.
Cleveland, Ohio

Following the discussion on Amblyopia at the 1934 meeting of the Academy, Chairman Melvin, at the suggestion of Dr. Wm. Feinbloom of New York, appointed a committee to continue the investigation of the problem: to clarify nomenclature and, if possible, to devise new methods whereby a more accurate control might be exercised. The report of that committee is herein submitted.

While primarily it is the purpose of this report to discuss the nomenclature of and diagnostic methods pertaining to amblyopia, it must of necessity include data upon which new criteria may be based. As stated in a previous report[1] to the Academy, any discussion concerning the general subject of subnormal vision must be along the divisional classifications of the Amblyopiae, namely; (1) those which are usually found and associated with general pathology or systemic disturbances, (2) those amblyopiae of traumatic or pathologic origin which have definite ocular identification, (3) those in which there are no constitutional symptoms and in which the ophthalmoscopic findings are negative.

To continue to classify the first two divisions under the designation of "congenital" or "acquired" is meaningless when viewed in terms of causation (for further discussion see [1]). That the terms "congenital" and "acquired" do pertain to the third group may be substantiated by any study of clinical data on the subject.

In the past there has been justifiable question as to the reliability of data pertaining to progress made in amblyopic training. This question centered around three main points, namely:

1. The factor of learning.
2. Variable size of the test objects.
3. Variable visibility of the test objects.

It would seem, therefore, that to obtain a more reliable criterion, these variables be eliminated if at all possible.

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*An abridgment of the material presented before the American Academy of Optometry at Chicago, Ill., August 23, 1936.

With this in mind, various types of visual testing apparatus were experimented with, Snellen charts upon which the letters had been arranged according to their visibility, the illiterate E charts, broken rings of Landholt, Classen Visual Acuity Meter, etc., and while each held some advantages over the others, each had some annoying deficiency which modified its usefulness. Following the suggestions made in the past few years, that some method of measuring at or near threshold would be more indicative, the Ferree-Rand projector and the Luckiesh-Moss visibility meter were tried, the Ferree-Rand eventually being discarded due to the time necessary for dark adaptation.

For those unfamiliar with the Luckiesh-Moss instrument, we quote a brief description from the Journal of the Franklin Institute of October, 1935. "This instrument consists essentially of two colorless photographic filters with precise circular gradients of density which may be rotated simultaneously in front of the eyes while looking at an object or while performing a visual task. The observer holds the instrument in approximately the same position that eyeglasses are worn, and with a finger of the right hand slowly turns a disk which rotates the circular gradients until the visual threshold or limit in the performance of the visual task is reached. The procedure is quite similar to that employed in operating a visual photometer." "The gradient filters not only reduce the apparent brightness of the visual field due to absorption, but also lower the contrast between the object of regard and its background due to the slightly diffusing characteristics of the photographic filters." . . . "The brightness of the retinal image may be varied by the gradient filters over a range which corresponds to 100 per cent in visual acuity or the threshold size of the object of regard."

The test object eventually selected was of the single bar type, its form being such that it gave equal visibility with respect to its longitudinal dimensions; its length being 60 mins. overall, greatest width 3.75 mins., narrowest 1½ min. All tests were made at 20 feet with constant illumination of 10 foot candles on the test object.

Subjects

An original group of twenty-two subjects between the ages of 12 and 17 years and showing a V. A. of 20/50 or less was selected. Of this group, twelve were eliminated because of existing general pathology, previous ocular pathology, or if previous amblyopic training had been undergone.

Among the remaining ten, 6 were male, 4 female; three having a strabismus associated with the amblyopia. Subnormal vision was present in the right eye of five, in the left of three, in O. U. two. All were given the same instructions which included total occlusion of non-amblyopic eye for two fifteen-minute periods daily, together with a specific routine of cutting of pictures, use of Wellsworth Amblyopic charts and of bouncing a ball.

The group of ten was then empirically subdivided into two of five subjects each and re-examined at definite intervals, at which time relative visibility readings were taken on both groups while Snellen letters exposed to only one.

TABLE I

Letters	N	R	T	S	Y	F
R. V.	4.6	4.4	4.8	4.1	4.6	4.5
P. E.			±0.05	±0.05		
Letters	E	O	B	C	D	
R. V.	4.7	5.9	4.6	4.8	5.5	
P. E.		±0.08	±0.05			
Letters	U	F	V	P		
R. V.	6.1	5.7	6.5	5.4		
P. E.		±0.06	±0.07			

The relative visibility of individual letters of three consecutive lines of the test chart of the American Medical Association, 1932. The individual values represent the arithmetic average of 150 single observations and involve 6 subjects of normal or near-normal vision. A few relative probable errors are presented to indicate the statistical reliability of the data. Fixation distance, 20 feet; intensity of illumination, 10 foot candles. Data taken with sensitometer.

TABLE II

The average probable errors presented in the last column may be applied to the individual values of relative visibility since the variations of the former from test to test are not great.

Sub.	Relative Visibility (At intervals of approximately two weeks)						Average Probable
ject	1	2	3	4	5	6	Error
1	5.70	5.38	5.67	5.83	6.10	6.24	0.07
2	8.65	10.7	9.35	13.20	14.10		0.16
3	4.90	5.60	5.78	5.58	6.02		0.07
4	3.13	3.21	4.92	5.42	6.14	8.15	0.09
5	3.86	4.84	7.01	8.50	12.30	13.10	0.09
6	2.96	3.90	4.75	3.32	3.50		0.08
7	1.32	5.61	8.50	10.70	13.35		0.08
8	2.54	4.14	4.48	4.50	5.00		0.09
9	3.01	3.94	4.44	4.04	5.14		0.07
10	3.80	5.32	7.50	7.20	8.60		0.10

Table II shows the relative visibility readings of ten subjects over the training period. Each reading represents the mean of 10 measurements on the visibility meter. It will be noted that in four subjects a constant increase in visibility was made, while in six the increase in

visibility was not continual but that a decrement occurred at different times during the training. In subject No. 1, the second test shows a decrease from 5.70 to 5.38, this loss not being regained until along in the sixth week. Again in subject No. 6 a loss 4.75 to 3.32 occurred after the fourth week and was not regained up to the time of conclusion.

It will be noted also that the difference between two successive measurements is several times as great as the probable error of the data, that is, the spread of the series of ten readings is only a small part of the difference obtained from one examination to another, e.g., in subject No. 1 the loss of vision at the second period was about 0.32 which is approximately four times the probable error, hence this loss of visibility in the interval between examinations is a real one and not due to chance.

From the table it will be observed that subject No. 1 showed the least response to treatment, however, the brightness-difference method was sufficiently sensitive to clearly indicate even these small changes, obviously subjects showing a greater response present a less difficult diagnosis. This simple and precise method of appraising changes in vision is not possible in other tests.

TABLE III

Each value of Relative Visibility represents the mean of 10 measurements taken with the Luckiesh-Moss Visibility Meter. The period of orthoptic training was approximately 10 weeks.

Subject	Relative Visibility			Probable Errors		Snellen Rating	
	Initial	Final	Ratio	Initial	Final	Initial	Final
†*1	5.7	6 2	1 09	0 06	0 12	20/200	20/140
2	8 6	14 1	1 63	0 11	0 10	50	30
3	4 9	6 0	1 22	0 07	0 07	200	100
4	3 1	8 1	2 60	0 09	0 11	140	25
*5	3 9	13 1	3 39	0 10	0 17	140	20
*6	2 9	3 5	1 21	0 07	0 08	200	100
†*7	1 3	13 3	10 3	0 01	0 12	300	30
*8	2 5	5 0	1 98	0 08	0 06	50	30
†9	3 0	5 1	1 71	0 06	0 07	140	80
10	3 7	8 6	2 32	0 09	0 09	40	20

*Exposed. †Associated with squint.

Table III shows initial and final relative visibility readings and the ratio of increase together with the probable errors and Snellen rating, initial and final. Compare subject No. 6 to whom the chart was exposed with No. 3 who did not see the chart except when the initial and final readings were taken. Also compare subjects No. 4 and No. 5.

In general, it will be noted that when large changes in vision occur this fact is revealed by both methods of appraisal, by the sensitometer method and by the use of test type, e.g., in subject No. 4 vision increases from 3.1 to 8.1 on the scale of relative visibility; and from 20/140 to

20/25 on the Snellen, however, the merit of the sensitometer method lies in the fact that small changes in vision may be readily and reliably diagnosed: obviously the detection of large changes presents no difficulty.

TABLE IV

Subject 8 (exposed)	Snellen	20/50	20/40	20/40	20/40	20/30
	R. V.	2 54	4 14	4 48	4 50	5 00
Subject 9 (not exposed)	Snellen	20/140				20/80
	R. V.	3 01	3 94	4 44	4 04	5 14

Table IV shows the Snellen and relative visibility ratings of two subjects, one to which the test letters were exposed, the other not. It will be noted that, in general, the Snellen ratings correspond with those of relative visibility, however, the inaccuracies of the type-method is obvious when a study of subject No. 8 is made.

Thus the greater precision of the sensitometric method would seem to be a distinct clinical advantage and particularly so in the difficult case. Certainly experience in orthoptics indicate a real need for greater precision.

Summary

Upon reviewing the above data the following conclusions may be drawn:

1. That by the use of a new diagnostic criterion, i.e., brightness-difference, the three important variables may be controlled.
   a. Learning Factor—by the use of photometric stimuli as opposed to areal.
   b. Variable size of test object—by the use of a single test object of constant size.
   c. Variable visibility of test objects—by alteration of the brightness and contrast between the object and its background.
2. That through the use of a method which permits repeated measurements of the visibility of a single test object data of greater sensitivity are obtained.
3. That conclusions drawn from the two methods (Snellen test-type and relative visibility) correspond in general. However, the lack of precision of the test type method is revealed when precise measurements are available for comparison.
4. That progress made in cases of subnormal vision is more accurately determined by the brightness-difference criterion.
5. That while the Hanson-Grut graph of visual acuity increase is apparently correct in form, a true interpretation is impossible because of the insensitivity of the methods used.
6. That further important deductions probably could be made from these findings, but until more extensive data are available it does not seem advisable to extend the analysis.

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DR. R. M. HALL,
SMYTHE BLDG.
CLEVELAND, OHIO.

DISCUSSION

DR. J. NEUMUELLER: As Dr. Hall pointed out it is quite important to know before hand whether orthoptic treatments in cases of squint have a fair chance of success. In connection wtih this prognosis we have to offer the following suggestion which is based upon a test introduced by Prof. Hering in the eighties of the last century and has been revived by Dr. Bielschowsky here in the United States. The information which I impart here came to me from Dr. Bielschowsky who, as you know, is now chief of the research clinic of the Department of Research in Physiological Optics, Dartmouth Medical School, Hanover, N. H.

The purpose of the test is to establish whether or not retinal correspondence exists in the case of squint. By correspondence we mean the innate function that the 2 retinal pictures can be fused together into unity in the brain centers.

The apparatus for the test consists of a long (about 12 inches) tubular light source such as is used in illuminating show cases which is to be mounted so that it can be rotated around its center point. Around the center of the tube there can be a band about one-half inch in width which serves as the fixation point.

The technique of the test is that the patient occludes the left eye and fixes the fixation mark of the vertical lighted tube with the right eye for about 10 seconds. Then the tube is turned to a horizontal position and the fixation mark is fixed with the left eye under occlusion of the right eye. This procedure creates after images and the patient is asked to draw on a piece of paper just how he sees the two lines. If the patient draws a cross we have a definite proof that correspondence between the two retinas is existing and therefore the chances to obtain single binocularity by means of orthoptic treatments are good.

A METHOD OF SUBJECTIVE REFRACTION: THEORY AND TECHNIQUE*

Robert J. Beitel, Jr., Ph.D., F.A.A.O.
Department of Visual Science, American Optical Company
Southbridge, Mass.

INTRODUCTION

The essential point of difference, from the standpoint of method, between subjective and objective tests of refraction lies in the nature of the operations of measurement employed in each.

In the objective measurement of the refractive conditions of the human eye (e.g., retinoscopy, ophthalmometry) the accuracy of the results to be obtained is determined largely by instrument limitations and the discriminative ability of the examiner.

On the other hand, in the subjective tests dependence for accuracy of measurement is placed upon the report of the patient. This report is taken to be an index of the patient's ability to discriminate, for example, a letter or figure from a "blur," a clear letter from a blurred letter, one letter from another, the relative blackness of the lines on the astigmatic chart, and so on. The conditions which determine the nature of the patient's report are the optical properties of the retinal stimulus, the integrity of the patient's neuro-muscular system, the patient's previous training and experience, and the nature of the instructions given to the patient.

Another important difference, from the standpoint of diagnostic purpose, has hitherto obtained between objective and subjective methods. The objective tests have for their objective the proper correction of the refractive error and the proper control of the function of accommodation with the production of the maximal visual acuity *permissible*. The subjective refraction test, on the other hand, has been aimed at the determination, by means of lens substitutions, of that lens or lens combination with which the patient obtains maximal visual acuity for distant and near test objects with a fair degree of comfort. That such a difference exists in the opinions of some practitioners is evidenced by their disposition to use the subjective test simply as a "check" test of their objective findings, and their tendency, in some instances, to disparage subjective methods on the grounds that they are "unscientific."

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A recent noteworthy advance in the development of subjective tests has been made by J. Robinson Cohen.[1] Cohen recognized the difficulties and sources of error inherent in the older methods and, with due regard for well-established optical and psychological principles, devised a method and technique whereby these pitfalls may be avoided. Cohen's paper warrants careful study.

In view of the recent interest in subjective methods it has been considered profitable to examine the older subjective method for its fundamental principles and to reconstruct, if possible, a method based upon these principles.

THE PROBLEM:

In examining a pair of eyes, whether by objective or subjective methods, we are not concerned solely with the determination of the refractive error. We must be concerned with the *behavior* of that pair of eyes and of the individual possessing those eyes—both with respect to his refractive error and with respect to his corrected refractive condition. In short, we should know just what effect—optical, physiological, and psychological—each change of lens value has on our patient, for, as mentioned previously, these are the conditions which determine the patient's response to visual stimulation. Obviously, this is an impossibility in terms of our present state of knowledge. The method of science is the method of measurement and the complete answer to our problem can be obtained only when these factors (optical, physiological, psychological) can be directly measured and described quantitatively. Let us see what this would mean. It would mean, first, that we should obtain measurements of the magnitude, intensity, duration, etc., of the retinal (light) stimulus and of the physico-chemical changes taking place in the receptor (rods and cones), connector (nervous system), and effactor muscles) systems. It would be necessary to know just what effect the present and past history (physiological and psychological) of the organism had upon these changes. Secondly, it would mean that, in order for our measurements to yield us information either for purposes of diagnosis or prediction, it would be necessary for us to obtain descriptive correlations of all of this quantitative data.

Let us examine our present possibilities for measurement. We can determine approximately the optical properties of the visual stimulus (extra-ocular). We can determine the influence of various lenses upon these properties prior to their reaching the eye. These things we can measure, but the problem arises: How, then, do we obtain "measurements" of the error of refraction using "subjective" procedures? Before answering this question it will be necessary to examine briefly the psychological problem involved.

The question raised here concerns the problems of stimulus and response (e.g., test object and patient's report) and the description of their relationship[2, 3]. It is obvious that, in order for any response to occur, changes antecedent to this response must have taken place—a

stimulus must have been present and nerve and muscular activity must have occurred. If the stimulus varies we may expect variations in neuro-muscular activity and, consequently, variations in the ultimate response that is made. In these terms we may say that any response "describes," or is a description of, its necessary antecedents. This description is unambiguous only if one set of conditions is alone capable of producing the particular response. To the extent that the response accurately describes its antecedents, to that extent do we find a close functional correlation existing between this response and its antecedents. In this sense we may say that our problem consists in obtaining close functional correlations between stimulus and response, for, to the extent that a response actually occurs, to that extent may we infer the integrity of the neural and muscular apparatus. Should the response not vary with variations in the stimulus or should the response vary in an inconsistent manner with variations in the stimulus, we are justified in assuming that the responsibility for such behavior rests with the intermediate processes—the neuro-muscular mechanisms.

The applicability of this mode of reasoning to the methodology of the "subjective" procedure should be apparent. Taking the patient's report to be a valid description of its necessary antecedents—neuro-muscular activity and stimulus—we vary the stimulus (optically) and, by noting the variations in response, obtain functional correlations the consistencies of which permit our stimulus variations to be considered in terms of measurement. In clinical language this amounts to saying: If we place before the eye a given lens which affords maximum acuity and obtain the same report upon each application of this lens then we may assume the lens value so employed to be a measurement of the patient's manifest refractive error. However, if upon successive presentations of this lens value the patient's report indicates that the acuity is varying, then we may assume that the reason for the variation may be sought for in the accommodative mechanism (i.e., the intermediate neuro-muscular process).

With these thoughts in mind, the writer has attempted to develop a subjective procedure which would meet as many as possible of the considerations referred to previously and which would prove to be efficient and practical. The method employes an "optical yard-stick" (an *arbitrary* procedure of using readily discriminable lens values) which is applied in both ascending and descending order to permit comparable report, or acuity, comparisons. The need for a procedure which would yield more adequate data upon the refractive error and accommodative functions than that generally allowed by the usual "plus six (+6.00) fogging" system may be felt on both logical and practical grounds.

In the following pages the general outline of this subjective procedure is presented. Obviously, many little refinements are possible and may be used with advantage, the outline serving simply as the essential support or framework. The procedure is adaptable to the customarily employed instrumentation and equipment.

OUTLINE OF PROCEDURE:

1. Determine patient's naked visual acuity, both monocularly and binocularly.

This should be done with considerable care. The V. A. should be so recorded as to indicate the number of letters actually discriminated on the line indicating the best acuity. For example, if the patient discriminates only four of the six letters on the 20/30 line, the V. A. should be recorded as 20/30-2, indicating that all but two of the letters on the 20/30 line were discriminated. (Since all the lines are not of the same length, a more accurate method of recording would be one which would include information concerning the total number of letters in the line referred to. In the example above let us say there are six letters on the 20/30 line, four are discriminated, two are not; hence, we record the V. A. in this instance as 20/30-2/6).

2. Occlude one eye, e.g., the left eye.

3. Bring +0.50 D sphere before the right eye and question the patient as follows: "What effect does this have?" At this point the patient is regarding the row of letters or figures which indicated his best V. A. without any lenses before his eyes. (If the conventional acuity chart is used, an ideal form of it, for the purposes of this procedure, would be to have a number of rows of different letters or figures for each angular designation or acuity reading. These figures should be presented a line at a time or isolated in other acceptable ways. This manner of presentation of the figures will tend to eliminate errors due to familiarity or recognition of their form. With such a procedure, one need only change the figures and instruct the patient to discriminate them—e.g., "Read these letters.")

4. If the patient reports that the letters become completely blurred and indistinguishable we may assume for the moment that he is myopic. (The mode of procedure in such cases will be given later.)

5. If the patient reports that the letters do not change, or that they become more distinct, or that they become somewhat blurred but remain distinguishable as letters—we then increase the spherical power by another +0.50D, and question again as in (3).

6. If, now, the patient reports that the letters are indistinguishable, we show the next larger line of letters, instructing the patient to read them. If he is unsuccessful, we present the *next* larger line of letters and question as before. (Should the patient report that the lines become more distinct as the plus (+) spherical power is added, we continue to increase the plus (+) until the patient reports them to be blurred and continue in the manner being described.) If he is unable to read this line of figures, we present the *next* larger type, and so on, stopping with the line which the patient can just barely discriminate.

We proceed in this manner until we find that an added increase of +0.50D results in a *disproportionate* decrease in visual acuity, e.g., a

drop from 20/50 to 20/100, or 20/70 to 20/200, etc. At this point we allow the lens combination which yields this low acuity to remain in the phoroptor, or trial frame, and instruct the patient to casually observe the chart for a minute or so. This is our "fogging" lens, and it will be unnecessary to increase the lens power beyond this point.

7. After this lens value has been in place for several minutes we determine whether or not the patient's V. A. has changed. If not, we *gradually* reduce the plus (+) lens power by 0.25 D steps until the patient again obtains 20/40 V. A. (This time the plus (+) lens value may be slightly higher than that lens power, found previously in the ascending series, which afforded 20/40 V. A. If such is the case we may have some indication of the amount by which the accommodation has relaxed—a diagnostic feature often overlooked when the usual "fogging" method is employed.)

8. At this point (20/40 V. A.) the eye is usually in about the right condition for the determination of astigmatism since, optically, the foci of all the meridians are in front of the retina and minus (—) cylinders may be used for the correction of the astigmatic error. (In cases where the astigmatism is of low amount it will often be found practicable to increase the V. A., e.g., to 20/30, prior to making the determinations.)

9. If the "clock" dial test object is used, the patient is asked: "Which lines *appear*, or seem to you to be the blackest and most distinct?" (Do not ask, "Are the lines equally black?") Frequently, it is of value to instruct the patient to tilt his head from side to side and observe the changes in relative blackness of the radiating lines.)

10. If the patient reports that the lines appear equally black and distinct, no astigmatism (total) is indicated.

11. If the patient reports certain lines to be blacker or more distinct than the rest, astigmatism is indicated. It means in other words, that the lines which are blackest represent the foci of the meridian which is most nearly in focus with respect to the retina—consequently, the foci of the other meridians are anterior to this focus and *minus* (—) cylinders with their axes at right angles to the clearest-seen meridian will be required to bring the blurred lines to equal blackness with the blackest lines.

12. When, by the addition of minus cylinders, all the lines are made to appear equally black and distinct, the V. A. chart should be presented again and the spherical power should be altered to produce the maximum acuity possible.

The same procedure is then followed for the left eye (with the right eye occluded). It is best, however, to allow the patient to regard the distance chart for a minute or so with the left eye prior to beginning the examination in order that this eye may become properly light-adapted to the testing conditions.

After both eyes have been corrected in this manner, we determine the patient's visual acuity binocularly, with the corrections before the eyes. Under these conditions it may be found necessary to increase or decrease the spherical components. However, the best rule to follow here is the old familiar one: Give the *maximum plus* (+) *spherical power* that will still permit maximum visual acuity.

Referring now, to step number 4 in the above-outlined procedure, it may be stated that the procedure for determining the correction for myopia embodies essentially the same principles, as will be seen from the following outline.

1. We proceed as in the previous outline, up to and including (4). (It may be found, in cases of low myopia, that an additional +0.50D sphere will be required to produce the complete blurring effect.)

2. Remove lenses. Bring a —0.50D sphere before the eye and obtain the patient's V. A.

3. Add another —0.50D sphere and again obtain the patient's V.A.

We proceed in this manner until we find that an added increase of —0.50D results in a disproportionate *increase* in visual acuity (e.g., from 20/50 to 20/25, or 20/30 to 20/15).

4. We return to that lens value which affords 20/50 V. A. and increase the minus (—) spherical power until 20/40 V. A. is established.

5. At this point, we expose the astigmatic dial and correct for astigmatism as outlined above.

6. When the lines are made to appear equally black, we *gradually* increase the minus (—) spherical power until the V. A. is 20/25. (There are many views as to the degree of visual acuity which a myope should be permitted to enjoy—much depends upon whether the myopia is progressive, functional, or "stationary.")

7. After this correction has been determined we add considerable minus (—) spherical power to stimulate accommodation and then we reduce the minus (—) power until we have obtained that lens value which will still afford 20/25 V. A. A comparison of the lens value affording this acuity in both the descending and ascending series will give us some indication of the way in which the accommodation is responding.

In cases of high astigmatism the effectiveness of this technique is readily noticed. It will be found that the technique is quite sensitive in disclosing conditions of this type. It will be seen immediately, for example, that the addition or reduction of 0.50D spheres at the point of maximum acuity (with or without spheres, if so obtained, with astigmatism uncorrected) will not be effective in increasing the V. A. True, the patient's description of his visual environment and of the acuity chart, initially, may justify the immediate inference that he is astigmatic. However, we are assuming here that this technique is being em-

ployed under the worst possible conditions, i.e., without knowledge of patient's history or symptoms, and without assistance of data obtained prior to this subjective test.

It may be objected that this procedure entails considerable time, especially in recording the acuity data. This is true if one carries out the procedure in detail. However, for all practical purposes it would be necessary only to bear in mind those lens values in the ascending and descending series which afford maximal acuity and those values which indicate the disproportionate decreases or increases in acuity.

Illustrative case: Male, act. 27.

Phoroptor Reading	Right Eye V. A.	Phoroptor Reading	Left Eye V. A.
0.00	20/15	0.00	20/15
+0.50	20/20-2/6	+0.50	20/15
+1.00	20/40-2/5	+1.00	20/30-1/5
+1.50	20/60	+1.50	20/60-1/5
+2.00	20/70-1/4	+2.00	20/70
+2.50	20/100	+2.50	20/100
+3.00	20/400	+3.00	20/300—
+3.00	20/400	+3.00	20/300—
+2.75	20/300	+2.75	20/200
+2.50	20/100-1/2	+2.50	20/100
+2.25	20/100	+2.25	20/80
+2.00	20/70-2/4	+2.00	20/60-2/4
+1.75	20/60-2/4	+1.75	20/50-1/5
+1.50	20/50-3/5	+1.50	20/40
+1.25	20/40-3/5	+1.25	20/25
+1.00	20/30	+1.25◯.25CX75°	20/20-4/6
+1.00◯—.25CX15°	20/25-4/6	+1.00	20/20-1/6
+0.75◯—.25CX15°	20/15-3/6	+0.75	20/15-1/6
+0.50◯—.25CX15°	20/15	+0.50	20/10-5/7
+0.25◯—.25CX15°	20/10-4/7	+0.37	20/10-5/7

O.D. +.25◯—.25CX15°
O.S. +.37 Sph. V.A./O.U.20/10-4/7 (Maximum acuity)

DISCUSSION:

In the above case it is seen that the "fogging" lens, as determined by the ascending series, is +3.00D sphere. Upon comparing the V. A.'s for comparable lens values in both series it is seen that, in general, better acuity is obtained with the same lens values in the descending series than in the ascending series. This result may be attributed to the operation of two variables, or factors—one, the inhibition or relaxation of accommodation; the other, the optical shift of the hyperfocal interval (as determined by the caustic) occasioned by the "fogging" technique. The fact that, in some cases, no differences are observed between both ascend-

ing and descending series would lead us to believe that the factor more responsible for the variations that occur is the accommodative response. There is, however, the possibility that in such cases the dimensions of the hyperfocal interval may be negligible.

Some question may be raised concerning the reason for the disproportionate decreases and increases of visual acuity with the application of an equivalent dioptric change in a series of changes. While this seems to work out empirically in most cases, there are cases in which it is quite difficult to detect, possibly owing to the nature of the progression of the size changes of the acuity chart figures. The optical basis for the effect is, at present, hypothecated in terms of the nature of the caustic and the optical departure from the posterior limit of the hyperfocal interval.

That such a procedure may also be used to advantage in retinoscopy is apparent. However, its value as a subjective procedure lies in the fact that its application is to a large extent arbitrary. That is, the lens changes are made in a deliberate, arbitrary manner and the subject's response is noted; whereas, in former methods the subject's response determines the nature of the subsequent lens changes. This reliance upon the judgment of the subject as to the "better or worse" characteristics of the chart is one of the most objectionable features of subjective testing. The unreliability and variability introduced by such a procedure reduces its value both as a refractive and diagnostic procedure.

One aspect of procedure in subjective refraction tests that should warrant careful attention is the matter of properly instructing the patient, beforehand, in the part he is expected to play. As mentioned previously in the outline, the patient is asked the question "What effect does this lens have?" This question is worded thus for the purpose of eliminating the element of suggestion inherent in such questions as "Is this better?—Does this lens blur?" etc., etc. But the question "What effect does this have?" is a difficult question for some patients to answer particularly if the patient is unintelligent, relatively limited as to descriptive vocabulary, or if the actual lens changes differ by small dioptric amounts. For this reason, it is important that the patient be taught or instructed in the manner of observation. One satisfactory method of instruction consists in placing a few lenses of different power and character before the patient's eyes and instructing the patient to observe and report on the observed effects. By this means a convenient method of rapport or communication may be arranged between examiner and patient.

Another pertinent problem is the question of the effect of "fogging" upon the accommodation. To what extent does inhibition or relaxation of accommodation over and above that amount necessary to disclose the manifest refractive error actually occur? What conditions of "fogging" will disclose this? For the optical control of accommodation, fixation and fixation distance must be maintained constant. By "controlling" accommodation we mean controlling it with reference to a given distance of fixation. For this reason it is important that some acuity is preserved

during the "fogging" procedure. To completely fog or blur out the acuity, a frequent procedure with the usual fogging technique, gives one no legitimate reason or excuse for assuming that by this means accommodation has been put under control. It will be noted that, in the method suggested in this paper, some acuity is always preserved for it is only with reference to the effect upon acuity that inferences may be drawn regarding the accommodative response.

In conclusion, it should be re-emphasized that methodical procedure and careful measurement are requisite for acceptable data.

DR. ROBERT J. BEITEL, JR.
DEPARTMENT OF VISUAL SCIENCE
AMERICAN OPTICAL CO.
SOUTHBRIDGE, MASS.

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EDITORS

DR. CAREL C. KOCH
1501 Foshay Tower
821 Marquette Avenue
Minneapolis, Minn.

DR. JACK I. KURTZ
1501 Foshay Tower
821 Marquette Avenue
Minneapolis, Minn.

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RECENT DEVELOPMENTS IN OPTOMETRY*

The year 1936 will long stand forth as an outstanding one in optometry, as it was during that year that a number of important developments were first presented to the profession, each of which will have a very marked effect upon visual science. It certainly is not often that any profession can point to as many outstanding and far-reaching new developments as were presented to optometry during the year just passed. The fine work done by the men who made these presentations will make the year 1936 one long to be remembered in circles dealing with visual science.

Some of the optometrists who so markedly advanced our knowledge of ocular things during the past year are Dr. T. A. Brombach of San Francisco, Calif.; Dr. William Feinbloom of New York City; Dr. Z. J. Schoen of University, Virginia; Dr. Brant Clark, then of Los Angeles, California and now in San Jose, California; Dr. Edwin Forbes Tait of Philadelphia, Pa., and Dr. Ray Morse-Peckham of Detroit, Mich. Each of these men presented to the profession material which in some particular manner increased the fund of knowledge which we now possess and

*An abridgment of the material presented before the Minnesota Academy of Optometry at Minneapolis, Minn., Jan. 31, 1937.

which, because of the fine manner in which the research was done, has added much to the general usefulness of optometry to the public at large.

To be sure, much of the work, the results of which were presented last year, was done prior to 1936. Many of these men have been working on these self assigned projects for many years, devoting much time, money and energy to accomplish something of value for the profession they so loved and for the technical field to which they were devoting their lives. None of this group has anything he wishes to sell his brother refractionists. Most of them are in private practice and where this was true the private practice suffered because of the time spent in research work, which has now proved to be of such benefit to the profession as a whole. It is the writer's intention in this paper to review some of these recent developments in optometry.

According to Brombach[1] a high or low tonicity finding of the ductions may be reflected in abnormalities as shown in the perimetric chart in taking the color fields. In other words Brombach claims that his experience with some 25,000 optometric cases in which very careful color fields were taken, leads him to believe that in certain cases in which the various duction findings were at some variance with the expected normals, the reason for this either high or low tonicity finding might be found in a searching examination of this same patient's color fields, taken on various occasions and under various conditions. The visual color field charts developed by this series of field studies then offering or becoming tangible evidence of, the proper course to pursue, in eradicating these anomalies of the stimulus to the muscles controlling the ductions.

Brombach also points out that even if the color fields are restricted it does not necessarily follow that the field for form and motion will be restricted and also that if the field for form and motion is found to be restricted it does not necessarily follow that the color field will be found to be restricted. He further points out that the form field may be restricted without affecting the fields for either motion or color and that if diagnostic work of value is to be done with the perimeter, all three of these fields for both form, motion and color must be given their proper place and care in ocular examination routine.

The work of Brombach stresses further the various conditions which are known to affect central vision as well as the fields of vision and also the newer diagnostic material which his work up to this time leads him to strongly suspect of having an important bearing on refractive work. These conditions he lists as follows: (1) the elimination and control of certain improper hygienic habits and poisoning, due to unorganized bodies introduced from without, which are found, by means of charting color fields to have a harmful affect upon the patient. (2) The affects of certain drugs upon the tissues and the diagnosis of these affects by means of field charting in conjunction with refractive work. (3) The recognition of pathological indications through a study of the visual functions and a system of diagnosis of some disease based upon the

clinical evidence of various ocular findings. Brombach's work in this last group of studies deals chiefly with focal infections, functional disorders and ocular pathology affecting vision. It is a very important work and marks an outstanding milestone in the progress of diagnostic work in optometry.

Feinbloom's contribution to visual science comes in the field of correcting the vision of those patients generally classified as having sub-normal vision. By this is meant, those patients whose visual problems are such that no ordinary ocular correction will bring their vision up to a useful or satisfactory level. Feinbloom has devoted years to a study of the problems of these unfortunate patients and by means of his work has added much to their comfort and visual progress. His latest contribution and the one referred to by the writer at this time, deals with the correction of certain causes of sub-normal vision by means of the plastic contact lens.[2]

As has been known for years, the use of a contact lens in certain cases of sub-normal vision will do much to improving the patient's ability to see, yet the use of the contact lens has been so limited among those patients who could be benefitted by its use, that one might almost say that the knowledge we possessed on this subject was of no value, because of the technical difficulties encountered when prescribing the old style contact lens. The reason for this was, that the stock sizes of the contact lenses always were such poor fits that no patients were able to wear them with any degree of comfort for long periods of time. This was due to that portion of the contact lens which held the false cornea in place and which came in direct contact with the sclera, not fitting the anterior portion of the eye properly.

In working on these cases and in prescribing the old forms of contact lenses Feinbloom felt that if some method could be established wherein a mold could be taken of the anterior surface of the patient's living eye and then a contact lens be made from this mold, the contact lens which would result from this process would be used with much greater comfort than the old lenses which never did exactly conform to that portion or segment of the anterior surface of the eye upon which they were placed. Obviously there were several difficulties which had to be overcome before molds could be taken directly from the eye itself. In the first place some very low temperature, quick setting form of plastic mold material must be used that would not in any manner injure the delicate tissues of the eye. And next some technique would have to be developed which would enable the optometrist to remove the mold from the eye without bending or in any manner changing it, even for a minute portion of a millimeter. Another problem then presented itself in how to vulcanize the plastic mold material to the glass false cornea in such a way as to in no way change the contour of the mold. These were but a few of the many, many problems Feinbloom had to solve in developing a plastic contact lens without injuring the eye which was to use it, but these problems were

all solved and using certain plastic substances which he could mold directly on the eye, Feinbloom has been successful in producing a large number of plastic contact lenses which are now in use on patients in which these appliances are the only known methods of improving vision. And these new contact lenses are worn for hours without discomfort.

At the annual meeting of the American Academy of Optometry in August of last year at Chicago, Illinois, the writer was privileged to observe Dr. Feinbloom and his assistant while they went through the entire routine of making a plastic contact lens. Starting with the raw materials used in making the outer portion of the new contact lens; the glass lens which was to form the new cornea and the various appliances used in developing the lens, we were shown the process of mixing and cooking the batch, the mold taking itself, and the vulcanizing part of the work. Then the finishing and final fitting stages until the finished plastic contact lens was worn by the subject who had volunteered to sit while the lens was being developed to fit the anterior surface of his sclera and cover his normal cornea with a false cornea. The subject used in this five-hour demonstration was none other than the President-elect of the American Optometric Association, Dr. Harry E. Pine of Chicago.

Feinbloom in his new work in this field will completely revolutionize the entire science of fitting contact lenses. The old rigid stock lenses are now a thing of the past as the new individually molded contact lenses will supplant these as soon as the techniques necessary can be mastered by those optometrists who will elect to do this specialized form of work. These new lenses, because they can be worn with comfort, will prove to be a great blessing to those patients who are now suffering from forms of sub-normal vision that are correctable by this means.

Schoen[3] who far several years has been doing some experimental work in the field of time relationships between antagonistic extrinsic ocular muscles and the effect produced upon these relationships by varying accommodative effort, successfully applied to ocular tests a chronometric technique wherein it is possible to measure the duration of diplopia, and therefore the speed of readjustment of the visual axis following the application or the removal of prisms placed before the patient's eyes. Schoen finds in the data thus far recorded that there is a definite correlation between the findings of the standard refractive tests and those of the chronometric technique. He does find, moreover, and here is the practical application of his work, that in many cases where visual discomfort was reported, the standard tests revealed no imbalances of the extra-ocular muscles while the chronometric techniques revealed in these same cases imbalances of the convergence relationships. Schoen's application of the new techniques in this field is therefore of great value as his work will add to our methods of investigating the innervational relationships between accommodation and convergence, and while his study is as yet in the experimental stage we all look forward to his continuing his research with this new technique and a further report of his progress.

Clark's experimental work during the past several years deals with this same problem of binocular imbalances of the extra-ocular muscles, but Clark has attacked it on an entirely different front. His interest has been chiefly that of studying these imbalances in patients whose eyes are not normal and using as one of his chief diagnostic aids eye-movement photography.[4, 5] Clark's work has brought forward some very interesting material which will, without a doubt, have an important part in revising some of our theories of corresponding retinal points, as his research in stereoscopic vision using the photographic technic shows that an area on the retina as large as 1.5° may be used to fix a point, this being much larger than the macula and indicating that much additional research will have to be done before our understanding of these complex visual acts will be complete. His work in eye-movement photography also indicates that this type of technique, using suitable clinical equipment, would be a diagnostic aid in clinical optometric work as the optometrist would have an objective record of the behavior of the eyes as they were performing routine visual tasks. This is something which will come in time and the fine work of Clark in this field will do much to prepare optometrists for that day when suitable clinical equipment will be available.

Tait,[6] assisted by Sinn, completed and presented to the profession a series of controlled experiments which are the first of their kind ever to be made and which, now that the findings have been published are without a doubt of incalculable value to optometry. This series of experiments was conducted with the greatest of care and was supervised by an impartial group of examiners all of whom were pledged to accept the final findings as scientists, irrespective of their outcome. In other words, this piece of clinical experimental research, dealing as it did with a very controversial subject was the first of its kind ever to be attempted which had for its sole purpose the determination of the affect upon ciliary muscle tonus of the use of homatropine.

It seems strange after the years and years of discussion over the advisability of using or not using a cycloplegic to find in an exhaustive study of medical literature, no substantiating evidence or competent proof that the use of homatropine would result in a relaxation of the ciliary muscle which would be clinically uniform enough to enable the user to get satisfactory refractive findings or findings which would enable him to have more confidence in his work because of its use.

To be sure medical literature is full of references advising the use of homatropine in routine refractive procedure, particularly in young persons, but none of these authors give any sound reason for suggesting this technique of refractive procedure, nor for making the statement except to refer back to some previous writer who in turn refers to another, each taking the word of some one who had made the claim at an earlier period. This sort of thing takes one straight back to Donders, without any of the multitude who have advised the routine use of homatropine, going to the bother of really finding out for themselves just

how much this so-called relaxation of the ciliary could be relied upon. As I have said, a careful review of the literature disclosed a lack of controlled experimentation in this field. Many statements and opinions on the subject, beginning with that of Donders, are on record, but unfortunately none are acceptable as scientific data from the physiological viewpoint. Landolt considered that the principal value of the cycloplegic was in its effect upon "tonic" and "clonic" accommodative cramps or spasms. The modern refractionist who uses cycloplegics usually justifies his procedure by stating that the drug "relaxes the accommodation" by inhibiting the contraction of the ciliary muscle and thus eliminating the power of accommodation.

Tait shows, however, that this viewpoint is manifestly faulty unless the reduction of the amplitude of accommodation also reduces or eliminates the accommodative effort of the normal tonus or postural muscular activity of the ciliary muscle. Clinical experience constantly demonstrates that the accommodative amplitude above the tonic or manifest level is never used during a refraction procedure if care is first taken to make the patient artificially myopic with suitable lenses. The normal ciliary muscle undoubtedly possesses, as do all other live muscles, a tonus which manifests itself in this particular instance as a small but constant amount of accommodation, the effect of which was termed latent hyperopia by many who have discussed its effects but failed to understand its physiological nature. It is undoubtedly this constant or tonic accommodation, which when increased either by excessive tonic innervation or by actual metabolic changes in the muscle itself, gives rise to the greater levels of tonic accommodation usually considered as muscular cramps or spasms.

When analyzed from this standpoint, therefore, "clonic" and "tonic" spasms or "cramps" resolve themselves into the end effect of variations in ciliary muscle tonus. Clinical experience with prolonged atropinization has shown rather definitely that in many cases the level of tonic accommodation is varied considerably as long as the drug is effective but that when the influence of the drug wears away the tonus returns to approximately its former level. In the use of cycloplegics for refraction purposes, therefore, the important factor is not the extent to which the accommodative amplitude is inhibited but the way and the extent to which the normal ciliary tonus or a ciliary hypertonus is affected.

While this is a perfectly sound viewpoint, justified by common experience in clinical application, as well as one physiologically acceptable, it has not been recognized or utilized by previous workers. No accuracy in the interpretation of results under cycloplegia can be obtained, therefore, unless there is a more precise knowledge of its effects upon the tonic or hypertonic accommodation. With these facts in mind the authors determined to investigate the action of homatropine with respect to the way in which it might affect any variation in the normal ciliary muscle tonus, and thus arrive indirectly at the manner in which hypertonic ciliary conditions may be affected by the employment of the drug.

Suitable apparatus, subjects and procedure being decided upon the experiments were carried out which when finished, clearly indicated that when homatropine is used, in the manner in which it is used in many offices throughout this country, that there is no definitely predictable ciliary response which can be expected or which can be used as a basis upon which an ocular prescription can be written. In other words, the data obtained with homatropine cycloplegia is usable in refractive work only if the limits of possible clinical error are recognized. These limits of usual variability, as determined by Tait and his associates on the many clinical subjects used in this experiment are from 1.50 D of relaxation to 0.75 D of stimulation. All of the subjects used in this experiment were college students between the ages of 18 and 23.

According to Peckham[7] many visual school surveys have been made by groups of optometrists during the past decade, the published reports merely catalog the numbers in different types of refractive errors found. In none of these survey reports have there been grade by grade comparisons of findings, nor an attempt to correlate the visual findings with the scholarship ratings. Yet this seemed to Peckham to be the only logical reason for school vision surveys. From the scientific point of view we have no interest in the number of kinds of lenses that might be needed by a group of school children unless we know from actual investigation that the supply of such lenses will improve the scholarship of those with visual defects. We must further know which types of defects handicap scholastic effort and which types do not before we are warranted in insisting that school children must be provided with eyeglasses. Up to the present, the insistence that children with defective vision are thereby prevented from full advantage of the educational facilities of the schools has been solely from sentimental reasoning. The first step toward instructing the school authorities and the public as to the need for visual corrections for the pupils of the public schools must be the statistical proof that there is a relation between poor vision and poor scholarship. It is Optometry's duty to itself, claims Peckham, and to the state that has licensed its practice to make this contribution to the study of educational problems and further, it is Optometry's duty to make this investigation and this contribution to the world's knowledge because its members are better qualified than any other group to perform this task.

With this in mind, Peckham has undertaken a five year investigation to obtain information concerning seven major items: (1) Is there an increase of myopia during successive years of school life or is the proportion of myopes in the upper grades about the same as in the lower grades? (2) If there is found a definite increase in the number of myopes year after year, can we gather definite prognostic signs of visual or eye measurement characteristics by which those susceptible to myopia can be recognized in the first stages? (3) Are girls or boys more susceptible to myopia? (4) Is there a valid basis for the assertion that poor school room illumination is largely responsible for the onset of myopia? (5) Is

there a general decrease in visual efficiency, or a definitely general increase in visual inefficiency, during the school life of a noteworthy proportion of pupils? (6) Is there a statistical relation between visual efficiency and good scholarship, or between poor vision and poor scholarship, such as would be shown in the study of the visual efficiencies and student abilities of a large number of pupils? (7) Is there a definite relation between good eyesight and fast reading? Does poor eyesight of itself, or do certain refractive anomalies of themselves, tend to retard reading speed?

It is surprising how little real data exists on any of these important subjects, and it is also equally obvious that none of these questions could be satisfactorily answered by the study of a few pupils nor of a selected group. It is also plain that as to the first six questions no true answer could be found in a single survey, but that the same large group of children must be examined annually over a period of years. Accordingly, this program was planned for the annual examination of the same 10,000 pupils, or more if possible, for at least five years. The first year's work has been completed, in a manner which is thorough and sound and the results have now been given to the profession. To be sure this is just a preliminary report but as such it does much to place the profession in a position wherein it can evaluate its work for and with that of the educator. Optometry will look forward to the next and all subsequent reports of the fine work Peckham is doing in Detroit.

I have reviewed what I believe to be some of the most outstanding contributions made to visual science during 1936 by optometrists, but the few mentioned do not by any means cover the entire field of important new work that is being done. Hall of Cleveland is continuing his fine researches in the important and vital field of the non-operative treatment of squint. Hotaling and Ryer of New York City are now in their ninth year of prophylactic work on cataract and have now developed a new lens which may have much merit when fully tried out. Kurtz of Minneapolis is continuing his experimental work on the reliability of near-point accommodative tests, a work which has already given us much factual information. Parkins of Ord, Nebraska, is continuing his researches in the field of speed or reading while Kraskin of Washington, D. C. is doing some fine experimental work in the field of applied psychotherapy. These and many other optometrists are doing fine pieces of experimental clinical research work, the type of high professional practice which will bring lasting benefit to all mankind.

Carel C. Koch.

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SPECIAL REPORTS

THE CRITICAL ISSUE IN OPTOMETRY*

E. LeRoy Ryer, Opt.D., F.A.A.O.
and
Elmer E. Hotaling, Opt.D., F.A.A.O.
New York City

We do not belong to that amiable group of "men of compromise." Nor will we join it. Someone must put Optometry's long-term interests above his own short-term popularity.

Optometry is suffering from hurts that will not be healed by sweet-smelling incense however ingratiatingly administered.

A readiness to substitute expedient for principle, a lack of self-respect, a plethora of selfishness, narrowness, cheapness, dishonesty, and low aims account for many of these hurts but the most grievous hurt of all is that inflicted by her lovingly-pampered shopkeeper whose past nurtured and whose continuance insures the growth of that menacing incubus, the "chain" gang.

Recognizing the constitutional hardiness of the shopkeeping optometrist, a hardiness inevitably characteristic of all parasites, and apprehending the apathy of those most vitally affected, and afflicted, we shall attempt nonetheless to show that Optometry cannot withstand much longer the corrosive effects of his hypocrisy and greed.

Let it be understood clearly that we are not speaking of the vague corporate interests or chain-store magnates and their hirelings but of the individual optometrist who elects to pay lip service to professional stand-

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ards while conducting his practice in what the whole world recognizes as a trading place, call it shop, store, parlor, department, what you will.

This shopkeeper in Optometry is not an occasional piece, an isolated incident, a minor menace, but, as things stand today, *he* is Optometry!

Shopkeeping optometry has been given all the opportunities, or has on its own account appropriated them. Shopkeeping optometrists have dominated many state and local optometric organizations and unless the professional element in optometry stands firm they will attempt to dominate the A. O. A. itself and perhaps even take over the American Academy of Optometry, as it seems to be the purpose of that group to destroy everything useful and decent which the professional practice of optometry has developed and to reduce the science to the level of merchandising optical material. Shopkeeping optometry has been nursed by various industrial units whose expenditure for window displays alone exceeds in amount the annual endowments of all of our schools. Shopkeeping optometrists, we regret to admit, are still to be found on several of our State examining boards in optometry. In a word, shopkeeping optometry has been either tolerated or accepted by every factor in optometrical circles and rejected without exception by every factor outside those circles.

Shopkeeping optometry having been given every chance has failed to gain recognition, its policies have degraded that which inherently should be a noble profession into what today is little more than a glorified racketeering trade.

Shall those shopkeeping policies be continued just to save the face of the puppets who carry them out at the command of those whose immediate greedy interests seem better served by keeping Optometry in a shopkeeping groove rather than by permitting her to develop along professional lines?

Is it not time we faced that question with courage? Is is not time to bring to light the real methods and motives of this predatory shopkeeping group? It is time if, as we believe, many who are *in* it are not rightfully *of* it.

Throw the light along the course of this dominating group and from the A.O.A.'s inception to its latest sessions, will be seen the wrecks of attempts to establish modest professional standards. From the Physiologic Section in 1906 to Resolution No. 6, of 1936, every serious attempt to repudiate shopkeeping practices and recognize the inherent professional character of Optometry has been killed by this overbearing shopkeeping element.

No matter how professional and how conscientious have been the officers of the A. O. A., the shopkeeping element which have been permitted to belong to that organization have largely nullified the fine work of these men. And the fact that they were permitted to belong to a professional society has kept that from really being a professional organization which could fully function as such. These shopkeeping optometrists

would attend sessions of the A. O. A. and talk very professional at the meetings, but were at the same time advertising free examinations at home. They would sit through lectures conducted by some of the finest minds in refractive science and yet care so little about examination procedure itself as to hold it of no value in their own shops. This same group which could see nothing wrong with that form of optometry which considers the examination of the eyes merely incidental to the selling of glasses.

The piteous plea so readily advanced for the shopkeeper in Optometry is the outcome of the copious crocodile tears he has shed down the years whenever asked to consider professional standards, *personally*. True, he shouts loudly for professional standards in the abstract, for the other fellow, but, concretely, for himself? don't be foolish! True, he is most active and self-sacrificing in organization work; he is most professional at his association meetings after hours—and what hours! He takes high office and discharges the routine duties creditably; superficially he is most useful, fundamentally most harmful, his real activities behind the scenes being directed toward keeping organized Optometry from evolving to that point where she must openly repudiate the shopkeeping practice of what is essentially a professional calling.

The shopkeeping optometrist is dominant in the development of Optometry; he dictates how far it shall go; he turns thumbs down on every effort to advance professional standards the moment they seem likely to succeed; he ridicules and encourages powerful industrial factors to ridicule the few who pioneer along genuine professional ways; he exploits the results of the researches pursued by the serious professional groups but hates those groups; he sees more in common with the dispensing optician than with the professional optometrist; he shows what he thinks of professional services by giving his away, such as they are; he shows what he thinks of his merchandise by the excessive price he places upon it; he fills oculists' and optometrists' prescriptions though it kills respect for himself and for his calling; he protects a dishonest rebating system; he hangs out electric signs and insists he needs his shop window upon which to paste the decalcamania eye, without realizing the real mania involved; he holds to shop practice with distaste, he claims, and only in order to bring Optometry to the public eye; he refuses to see that he thus succeeds in bringing it to public attention as a business or craft; he insists that his customers could not find him in offices and homes similar to those in which other professional men are found by their patients; he sanctions little shops and nice little departments in jewelry or dry goods stores but stands aghast, mightily aghast at the present moment, at bigger and better shops than his own; he approves trade codes; he approves paying taxes on the material he uses as on so much merchandise; he glories in being an optometrist to the extent of his free examination or single-dollar fee but to the extent of his multiple-dollar glasses glories in ratio as a merchant; he is proud to be the head of an optical company; he sees or wishes he could see his name in a double-

column newspaper advertisement; he believes billboards a proper medium and uses them where he can afford it; he values highly the few precious transients and the repairs a shop front entices; he willingly pays big rentals so as to swap costly window space for a few gaudy pasteboard displays advertising some manufacturer's goods; he demonstrates the relative values he places upon his merchandise and his services by his invariably spacious, showy reception parlor and his meagre, dowdy two-by-four examining room; and keep always in mind, we are not speaking of the isolated, irregular optometrist but of the ever-prevalent regular who as a member of his local and state associations does much to dominate the mental processes of these organizations and thus does much to retard the progress of our profession.

Has any genuine, reasonably high standards of practice or behavior ever been required for membership in the A.O.A. or any of its state and local affiliated societies? What was required for membership in the A.O.A. when it started? Two dollars a year—and no questions asked. What is required today? Four dollars—and no questions asked. And from the dominating shopkeeping viewpoint this is considered more than satisfactory progress. How many think otherwise? A few thousand if we number those who honestly advocate and truly support genuine professional standards of practice.

Some of these are the back-bone of the American Academy of Optometry, the only organization with definite professional requirements. And while the A.O.A. has permitted itself to be used by its shopkeeping element to breed and uphold many hundreds of single and chain-store optical specialists, as the industry insists on terming them, logically even if unkindly, the American Academy of Optometry has bred a few hundred successful professional optometrists, and forms the seed-bed of future development.

If Optometry recognizes in time the value of the Academy in thus nurturing the life-giving principle of true professional practice and acts in time to replace the shopkeeping with this professional principle she still may pull through.

Giving the Academy a free hand to cultivate the professional field will be the wisest action Optometry can take, stifling the Academy the most unwise.

The American Academy of Optometry with no help outside its own relatively small membership has made optometric history in having advanced professional standards to a point where they cast disconcerting illumination upon the shopkeeping standards and ideals of certain optometrists and this will probably mean as it has in the past a retaliatory challenge on the part of this shopkeeping group.

The Academy, in the eyes of shopkeeping optometrists has committed the cardinal sin of taking professional standards of practice seriously, of acting upon them instead of just talking about them, of living up to them at home not just boasting about them at far-away con-

ventions, of declaring that Optometry is a profession in fact, not alone in theory, of demanding that as a profession it accept and honor the universally recognized rules and regulations, the ethics, of professional practice, of stating unequivocably that professions are not practiced in shops.

This shopkeeping group of American optometrists has never before let a professional body get this far and, though now a little panicky, they may yet be counted upon to pit their experienced forces against further advance. Because of the political power that this group can wield in the A. O. A. it is safe to assume that they will exert every ounce of energy to stem the inevitable tide of professional advancement.

Our aim is to make clear the issue between shopkeeping optometry and professional Optometry although we are well aware that pussyfooters inside and outside Optometry do not want that issue made clear. We are well aware that after being befuddled for 39 years many, even among those who have advanced to Academy status, will find it difficult and disturbing to think straight but we think Optometry has been given about all the time it will be given to quibble between the commercial and the professional principles of practice. Both friendly and unfriendly factors among those who supply its material and equipment, among those who supply its educational courses, among those who create its laws, among those who administer its laws, and among those who constitute its following are about ready to demand an unequivocal answer to the pressing question: is Optometry to be guided by a glass-selling policy or by a sight-saving policy; is Optometry to take its place among the trades or among the professions; *is Optometry to be applied by those who use defective eyes to build up better sales of glasses or by those who use glasses to build up better eyes?*

The shopkeeping advocate tries to keep the real issue from being clearly defined by arguing that he does good work and that anyone can do as good work in one place as in another, in a shop as well as an in office. No one can deny that but that is not the real issue. The real issue, and he knows it, challenges his belief that a profession, this one lone profession, contrary to all past experience, can break time-honored rules and not be penalized. He knows that professions are not practiced as trades nor in trade environment and he knows that no shop however camouflaged can pass itself off as professional environment but down in his heart he knows that he thinks more of his shop than he does of *his* conception of the optometrical profession; he talks profession because he likes the benefits that accrue to professional practitioners but he hopes to wiggle out of paying the usual price for these benefits; he hopes enough of his more simple-minded brethren will practice professionally to keep Optometry listed as a profession in the Departments of Education but while they do the shooting on the firing-line he does the looting behind it, safe in his shop—until recently.

He does not want the real issue defined because he dreads to face it.

Either through cussedness or abject fear, he stoops to any expedient to avoid meeting the issue openly and squarely because he knows that issue, stripped of all the sophistry and hypocrisy he has twined about it, involves nothing more, *and nothing less,* than getting out of shops and into offices.

The professional optometrists of America base their position and face the fact that to gain respectful recognition, all semblance of commercialism can be removed from optometry only by having those optometrists who still practice in shops, leave these shops and their merchandising ideas behind and advance their ideas and ideals to those of professional practice carried out in the professional background of the office.

In spite of all handicaps, Optometry has proved its competency, so competency is *not* the issue, the real issue involves full, unqualified recognition, and that will depend upon whether Optometry elects to remain commercial in shop or go professional in office—shop or office?—is the blunt question Optometry must face.

This professional principle was bound to come to grips with the thinking of the commercially minded optometrist, who will now do all in his power to thwart the efforts of those who are sincerely striving to place their profession in its proper place. Do you want this professional principle checked? What will the answer be and who will determine that answer?

It is not beyond the realm of possibility that this shopkeeping group might, to gain their own ends, attempt to seize control of the A. O. A. and because of this fact that organization has the arduous task before it of remodeling its machinery in order that it may completely function as a professional society. And the first step in this direction is to demand from its members a high standard of professional practice. If the A. O. A. is a professional organization it can only be composed of professional men. Shopkeepers have no place in it. However, while doing this the A. O. A. must still guard its legal and legislative lines, already exposed to savage attack from without—lines already weakened by shopkeeping defections. Hence the A. O. A. cannot be expected to divert too much attention from these pressing issues to issues involving research and ethical practice, these latter matters falling to the American Academy of Optometry to solve—yet for its own future the A. O. A. will have to raise its standard of membership qualification if it wishes to survive as a professional society.

There is a fundamental difference between the work that must be done by the A.O.A. and by the American Academy of Optometry. Optometry needs that of each and each should be permitted to reach its highest state of development in its respective sphere.

The fundamental intricacies of the work of the A.O.A.—political, legal, legislative, and social—are generally recognized. Let us deal here with the fundamentals of the Academy.

The basic requirement for fellowship in the American Academy of

Optometry is that one conducts himself, relatively, as other professional men conduct themselves.

The state vouches for each practitioner's fitness to practice so the Academy goes no further in this than to assure itself that a candidate is truly competent and of good character. The Academy is primarily concerned with where and how he practices, hence if he be in an office or residence and not in a shop (**which no one in the world** but the shop-optometrist considers professional) and if he be imbued with and governed by the universally accepted ethics of all professional practice, he is eligible to fellowship in the Academy where he can help and be helped toward fostering research and utilizing its results and otherwise improving his skill in the practice of his profession.

If professional optometry is to be rescued from the grip of a fatal commercialism, shops must go, offices must come, and to that end the American Academy of Optometry must be kept free, unmuzzled and unshackled, and every professional-minded man must support it so that the few gains professional optometry has made may be held while the A.O.A. is disentangling itself from the meshes of its still powerful shop-keeping element.

A final word: There are hundreds already eligible to fellowship in the Academy who are not, but who from every viewpoint, should be in it; and there are thousands more who by minor changes could conform fully to fellowship requirements, and profit thereby in more ways than one; and it is to these as well as to those already carrying on in the Academy that optometry must look for its highest development as a profession and it is to these, members and potential members of the American Academy of Optometry, that we make the earnest appeal to cherish and protect its independence and autonomy in order that the Academy in turn may cherish and protect in their integrity the professional spirit and the professional standards that the Academy, and thus far the Academy alone, has had the courage and the personnel to set up and maintain.

DR. E. LEROY RYER *and*
DR. ELMER E. HOTALING,
527 FIFTH AVE.,
NEW YORK CITY, N. Y.

BOOK NOTICES

OCULAR REFRACTIVE PROCEDURE, ANALYSIS, TREATMENT, by Thomas G. Atkinson, M.D. Published by the Professional Press, Inc., Chicago, Ill. 160 pages. Cloth cover. Price $3.00.

Dr. Atkinson rendered a great service to the profession in general

and to the busy practitioner in particular by writing this book—Ocular Refractive Procedure Analysis and Treatment. From the very first chapter he starts out with the fundamental factors essential to accurate refraction and as a keen teacher and practitioner he cuts out most of the unessential material which usually fill many pages in most of the books on refraction. In this book the student or practitioner can at once proceed to the problem he is interested in, without spending much effort and time on expository material which has no important bearing on the subject.

The book is divided into nine sections. The first and second sections deal with the physiological and psychological considerations. Section three is devoted to a very clear exposition of the accommodative and convergence relationship. The author briefly but clearly describes the various accommodative convergence abnormalities and suggests certain valuable points for differential diagnosis. The fourth and fifth sections are given to a discussion of the methods of determination and treatment of refractive errors, and abnormal coordination. The sixth section deals with visual field charting, giving a concise description of the methods as well as the different types of fields. Section seven is given to a very complete discussion of squint, its causes, types and methods of treatment, and the last two sections contain a description of many types of clinical test used in a modern refraction room. Procedure and analysis of the data obtained from the various tests and finally the disposition of the case.

This book by Atkinson is a valuable contribution to modern Ophthalmic literature and should find a welcome place in the office of any modern optometrist. J. I. K.

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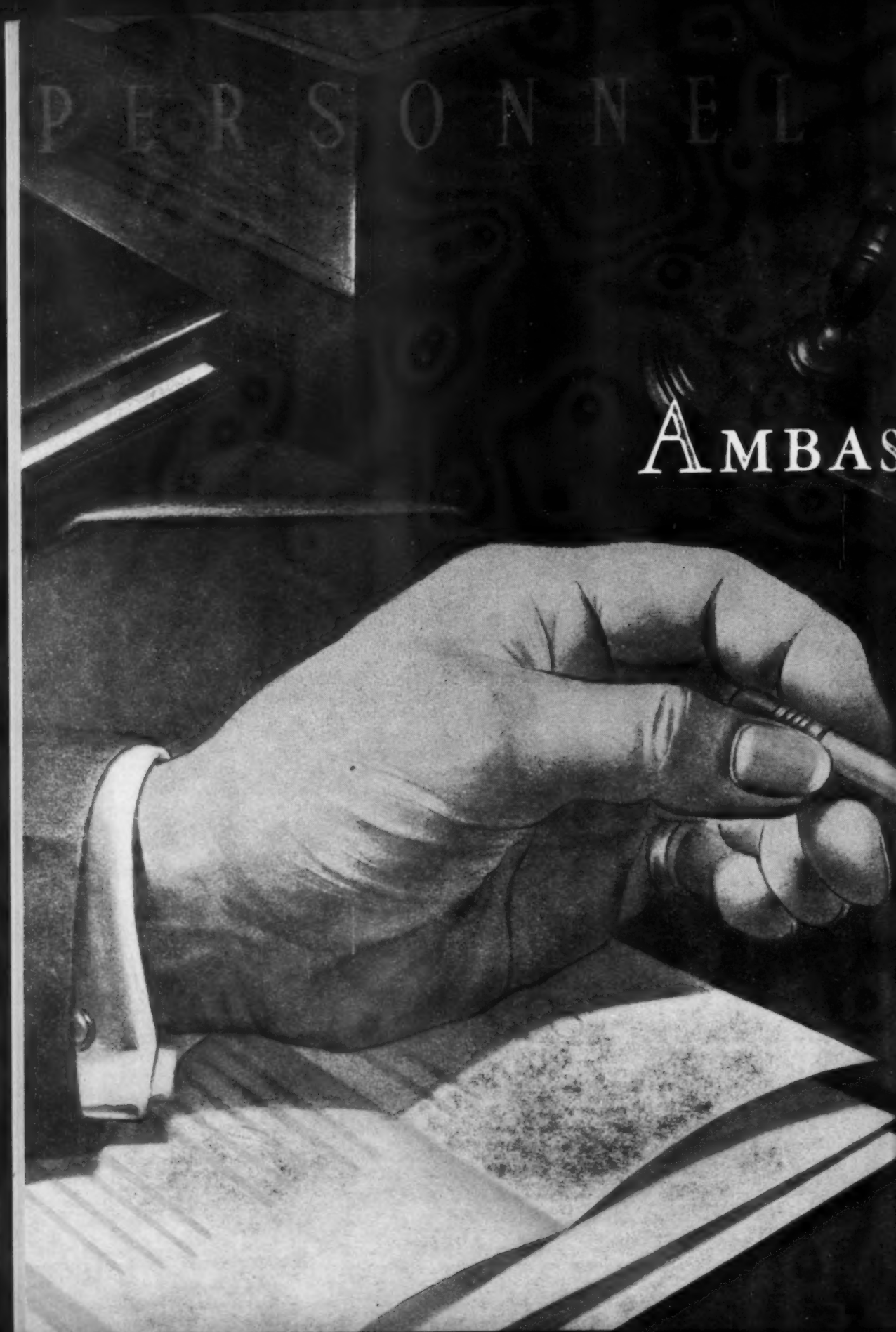
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WHILE THE DETECTIVE WATCHED . .

the guilty woman trapped herself

It was late and Mrs. "M" was in a hurry. As she elbowed her way into the elevator of a large department store, she was thinking not of the glasses unknowingly left behind but of the many things that remained for her to do. Suddenly she stopped. "My glasses, I must have left them at the notions counter"—and back she rushed to reclaim them . . . "No," politely answered the middle-aged woman who had waited on her, "I haven't seen your glasses but if we find them we'll let you know." . . . Suspecting that the saleslady had taken them, Mrs. "M" reported the loss to her refractionist. He immediately notified the local Riggs office to be on the lookout for a Benton Loxit mounting with Panoptik Soft-Lite lenses in a certain prescription. . . . Several days later the Riggs' manager had his attention called to a rather unusual request. A woman, claiming to have purchased her glasses from a refractionist in a neighboring town, wished the shape of the lenses changed. Upon checking them, the manager, much to his surprise, found that they were exactly like the glasses which Mrs. "M" had lost. . . . He suggested that the woman leave them and return later in the day. . . . Then he used the telephone . . . At three o'clock Mrs. "M" was waiting in the Riggs office with a detective. A few minutes later the suspect returned for her glasses. It was, as Mrs. "M" suspected, the saleslady. When told that the lenses could not be altered she started to leave only to be confronted by the detective. Questioning brought an admission of her guilt and the return of the stolen glasses to Mrs. "M" who in turn dropped the theft charge.

★

Unusual? Yes, such an incident is unusual, but it proves that Riggs' Service does not end with the sale of glasses. In this instance, close attention to details and quick thinking resulted in an unusual service to a customer's patient who, as a result, developed into a real booster for the customer. Here, too, the protection features of Loxit, Panoptik and Soft-Lite have real significance, for without them such a recovery would have been impossible.

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